

## **Integrated Coastal Observation System (ICOS)**

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### **LONG-TERM GOAL**

To enhance present capabilities in coastal marine observations by incorporating *in situ* biological, chemical, and physical sensors in an undulating vehicle with a mobile, sea-going laboratory van capable of further analysis of critical seawater properties in support of optical and acoustic studies carried out by the Office of Naval Research. This mobile lab/undulating vehicle system will be capable of rapid, high resolution, simultaneous measurement of key fields such as temperature, salinity, depth, dissolved oxygen, nutrients, dissolved organic matter, chlorophyll, particle size distributions, and particle (plankton) composition.

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## OBJECTIVES

The short term objectives of this award is to build infrastructure to support the following research activities:

- 1) The biogeochemistry of chromophoric dissolved organic matter (CDOM) in coastal waters
- 2) An examination of copepod and larvacean grazing effects on CDOM fluorescence and concentration in coastal seawater.
- 3) Physical/biological coupling in coastal waters of Antarctica, Norway, and the northwest United States.
- 4) Surface layer dynamics (upper 3 meters) affecting remote sensing

## APPROACH

The system will be composed of a towed undulating vehicle (5-12 knots, 3-150 m depth) housing state-of-the-art *in situ* sensors and a pumping system for further analysis on the flowing seawater in the laboratory van. The control system, sampling port, nutrient, and DOC analyzers will be permanently installed in the van so that rapid deployment is facilitated. In addition to the main tow body, a second towed body, the Mini-Shuttle may be deployed off the side of the ship for detailed study of the upper 3 meters of the ocean, a critical zone of study for satellite and airplane remote sensing efforts. The design of the towed sensors and lab van is flexible so that new sensors can be incorporated into the system as they become available. The proposed system will enhance existing instrumentation by increasing the depth capability to 150m so that any shelf area may be studied, adding state-of-the-art optical plankton instrumentation, and making the system mobile for rapid and facile deployment in any coastal area.

This is the only system of which we are aware with the sensor suite and multi-disciplinary expertise that we would consider a complete chemical, physical and biological measurement system. This system will enhance the local research activities and targeted small system studies. The high mobility and minimal setup time will allow comparison of small scale systems with larger systems to make regional and even global models of the coastal ocean possible. The proposed ICOS system will greatly enhance DOD's capabilities in coastal research and increase the infrastructure of the UMassBoston campus to become a world leader in coastal ocean observations and processes.

## WORK COMPLETED

This project has just begun in the last 4 months. Several component pieces, the SeaBird CTD, the Laser Optical Plankton Counter, the LISST-100 particle size analyzer, the 3-nutrient analyzer, and the master computer have been ordered with most of these having been delivered already. Several more pieces will be ordered shortly, including the van itself, the Video plankton recorder, the meteorological station, and the TOC/N analyzer. Labview has been chosen to integrate all instrumentation data streams, and instruments that have arrived are undergoing initial testing and incorporation into the data system.

## RESULTS

There are no results so far.

## IMPACT/APPLICATIONS

DURIP support of the proposed instrumentation will dramatically increase the ability of the Environmental, Coastal, and Ocean Sciences (ECOS) Department to do coastal research. The ECOS department is interdisciplinary in nature (with chemists biologists, physicists, policymakers, economists and lawyers) and relies heavily on ocean observations for the link between natural and social sciences.

UMassBoston currently operates three research vessels: the RV Neritic, a 25' Parker with hydrowinch, GPS, etc for near shore and estuarine research, the 46' RV Hurricane, and the 55' RV Looney. The Mini-Shuttle has been deployed from the RV Neritic in the Neponset River and the ECOShuttle has been deployed from the RV Hurricane. The 10' control van along with the winch is well suited for deployment from the RV Looney for local Boston Harbor and Massachusetts Bay work. However, the real advantage of the ICOS system is its mobility for use on any of a large fleet of UNOLS, private and university consortium ships.

Additionally, the Intercampus Graduate School of Marine Sciences and Technology (IGS) is a newly formed Doctoral and Masters Program combining the strengths of faculty and resources at the Boston, Dartmouth, Lowell and Amherst campuses of the University of Massachusetts. The ICOS system will provide many opportunities for students as well as faculty at any of the 4 campuses focusing on coastal and estuarine research.

Real-time data gathering and display in coastal areas is an exciting and memorable educational experience. The Control Van mounted on the RV Looney in Boston Harbor will be incorporated into undergraduate (Intro to Environmental Sciences, Intro to Oceanography, Environmental Studies Program) and graduate (Analytical Techniques in Environmental Sciences, Physical Oceanography, Chemistry of Natural Waters, Biological Oceanography) classes and independent research projects. The ECOShuttle system has already been an intimate part of 3 PhD dissertations and 3 MS theses, and with increased mobility and use, the ICOS system should provide a myriad of opportunities for ECOS and IGS graduate students as well as undergraduate research efforts. UMassBoston is an active recruiter of minority and women into the Ocean Sciences, and collaboration with Florida A & M University (an HBCU) should aid in these efforts.

## TRANSITIONS

The ICOS system is still being built, but proposals to use it for a dye study in the Hudson River and New Jersey Shelf region as well as to study krill overwintering in a Norwegian Fjord are pending.

## RELATED PROJECTS

- 1) Chromophoric dissolved organic matter in coastal waters. ONR funding to examine distributions, source variations, and processes affecting distributions in coastal oceans (Chen).
- 2) An examination of copepod and larvacean grazing effects on CDOM fluorescence and concentration in coastal water. ONR support (Urban-Rich).

- 3) US Globec NEP Study: Distribution and productivity of zooplankton. NSF support (Zhou).
- 4) A multidisciplinary study: the spatiotemporal distribution of circulation, temperature, phytoplankton and zooplankton in the western arm of Lake Superior. NSF support (Zhou).